Installation Instructions for
HI-4N MOTORCYCLE IGNITION

For more information, see www.cranecams.com

CAUTION: READ INSTRUCTIONS CAREFULLY BEFORE STARTING INSTALLATION.

INTRODUCTION

The HI-4N ignition system is intended for use with Harley-Davidson® motorcycles. The HI-4N replaces the original equipment (OE) electronic ignition system on 1978 and later models as well as the points and mechanical advance on early models. Will not work in 2000–2003 Sportster®.

WARNING: 1996 and later models have a vehicle tilt sensor that shuts off the ignition if the motorcycle rolls on its side. This feature is disabled when the HI-4N ignition is installed.

The HI-4N features state-of-the-art technology that allows adjustable advance and rev limit. A timing LED indicates static timing (top dead center) and gives diagnostic information. Two starting modes are provided: electric start and kick start. A tach output gives accurate tach readings even at the rev limit.

ADDITIONAL REQUIRED PARTS

FX series Big Twin® and XL series Sportster® models prior to 1984, FL series Big Twin® models prior to 1985, and all models with OE points will require OE timing rotor P/N 32402-83. This part is not included with the HI-4N installation kit and can be purchased separately, Crane Cams Part Number 8-1150.

COIL AND SPARK PLUG CABLE CONSIDERATIONS

We recommend replacing the OE coil. Coils used with the HI-4N must have at least 2 ohms primary resistance. Coils with 4 ohms or higher may be used, but may not produce optimum output. We recommend the following coils for single and dual-plug applications:

HI-4N Ignition With Single Plug Heads. Use Crane Cams P/N 8-3005 coil, which will fit in the stock mounting location on most H-D® motorcycles. You can also use two dual spark tower coils and ground one of the towers on each coil to the engine case or frame. You will have to fabricate a bracket to mount the second coil.

HI-4N Ignition With Dual Plug Heads. Use two Crane 8-3006 coils. You will have to fabricate a bracket to mount the second coil.

Crane FireWire spiral core wires are recommended for maximum performance. Do not use solid copper spark plug cables; they may cause interference with your ignition system and accessories.

REMOVAL OF POINTS IGNITION — EARLY MODELS PRIOR TO 1978

1. Turn ignition switch off and disconnect battery ground cable. Disconnect wire going from breaker points to Coil– (negative) terminal.
2. Refer to Figure 1. Remove ignition cover plate, gasket, and hardware (items 1-3). Save these items for later re-use.
3. Note location of breaker plate. There is a V notch in the breaker plate used for alignment. When you install the HI-4N, align the V notch in the same location. This should set the timing close enough to start the engine. Remove and save the two standoffs and washers (items 4-5). Remove the breaker plate assembly, wiring, cam, and advance assembly (items 6–10).

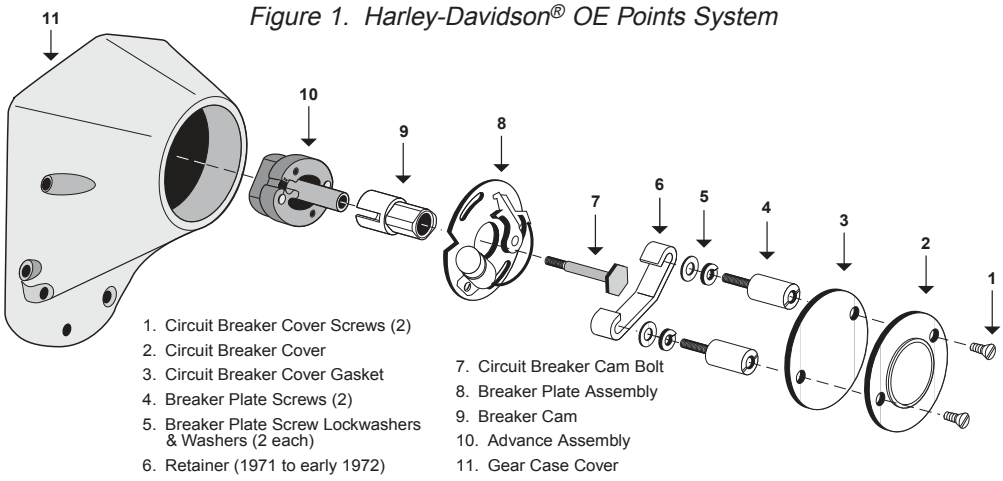
REMOVAL OF OE ELECTRONIC IGNITION SYSTEM—1978 AND 1979 MODELS

1. Turn ignition switch off and disconnect battery ground cable.
2. Refer to Figure 2. Disconnect wires going from ignition module (item 3) to coil (14).
3. Remove ignition cover plate and hardware (items 1 and 2). Save these items for later re-use. Remove ignition module (3).
4. Note location of timer plate (10). There is a V notch in the timer plate used for alignment. When you install the HI-4N, align the V notch in the same location. This should set the timing close enough to start the engine. Remove and save the two standoffs and washers (items 4-5). Remove the sensor, shield, timer plate, trigger rotor, and advance assembly (items 6-12).

REMOVAL OF OE ELECTRONIC IGNITION SYSTEM—1980 AND LATER MODELS

1. Turn ignition switch off and disconnect battery ground cable.
2. Refer to Figure 3. Remove OE ignition module and wire harness (items 1-4). You will disconnect two wires at the coil, wire going to the VOES (Vacuum Operated Electrical Switch), ground wire at the module, and the 3 pin plug (20) that connects to the sensor plate. Refer to shop manual for locations.
3. Remove ignition cover plates and gasket (items 5- 9). This will require drilling out two rivets. The rivets will later be replaced with two supplied self threading screws.
4. In order to remove the sensor plate cable, the cable plug (20) must be removed first. Use needle nose pliers to pull the terminals out of the plug. Then pull the cable through the exit hole at the bottom of the timing cover.
5. Note location of sensor plate (11). There is a V notch in the sensor plate used for alignment. When you install the HI-4N, you should align the V notch in the same location. This should set the timing close enough to start the engine. Remove and save the two standoffs and washers (10). Remove the sensor plate (item 11).

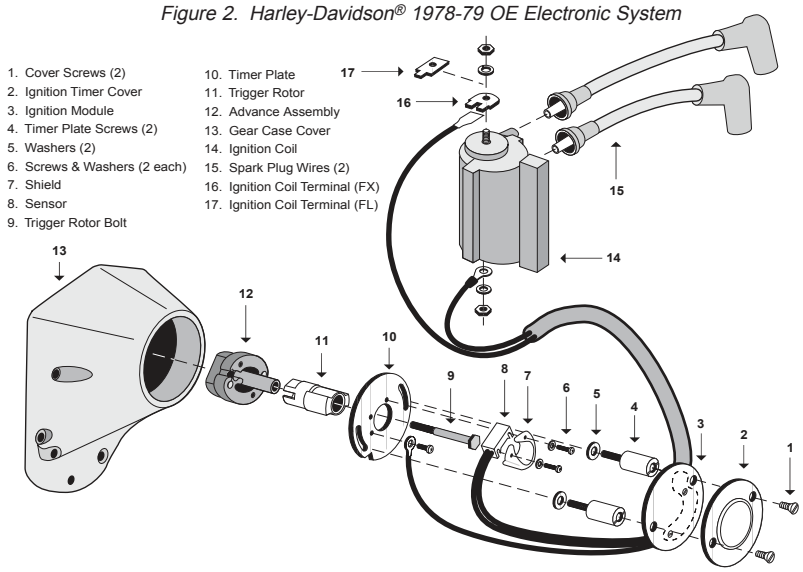
Figure 1. Harley-Davidson® OE Points System



1. Circuit Breaker Cover Screws (2)
2. Circuit Breaker Cover
3. Circuit Breaker Cover Gasket
4. Breaker Plate Screws (2)
5. Breaker Plate Screw Lockwashers & Washers (2 each)
6. Retainer (1971 to early 1972)
7. Circuit Breaker Cam Bolt
8. Breaker Plate Assembly
9. Breaker Cam
10. Advance Assembly
11. Gear Case Cover

Figure 2. Harley-Davidson® 1978-79 OE Electronic System

1. Cover Screws (2)
2. Ignition Timer Cover
3. Ignition Module
4. Timer Plate Screws (2)
5. Washers (2)
6. Screws & Washers (2 each)
7. Shield
8. Sensor
9. Trigger Rotor Bolt
10. Timer Plate
11. Trigger Rotor
12. Advance Assembly
13. Gear Case Cover
14. Ignition Coil
15. Spark Plug Wires (2)
16. Ignition Coil Terminal (FX)
17. Ignition Coil Terminal (FL)



HI-4N INSTALLATION

Refer to Figure 4. The HI-4N requires OE timing rotor P/N 32402-83, or Crane Cams Part Number 8-1150. Check your rotor (9) for correct part number. For models prior to 1980, use the supplied 10-32 x 3/4" bolt and washer to mount the rotor.

1. Install HI-4N system in place of OE breaker or sensor plate. Rotate the HI-4N about 90 degrees to give better access to the cable exit hole in the gear case cover. On some early models it may be necessary to enlarge this hole. Install the HI-4N first, then push the cable through the hole. Align the V notch on the HI-4N same as the OE plate you removed. Use the OE standoffs to secure the HI-4N. You must use lock washers under the standoffs for proper clearance between the HI-4N and cover plate. Do not fully tighten the standoffs until the timing has been set.
2. Route the HI-4N harness along the frame rails to the coil. Make sure that harness will not be chafed or burned by exhaust heat. Secure harness with tie wraps. Do not install timing cover.

HI-4N HOOKUP

Crimp terminals and hardware are supplied for your convenience. Use the ring terminals for coil hookup. Use male-female quick disconnects for connections to the tach and vacuum switch (VOES). Tape up unused wires.

NOTE: Damage will result if the brown tach wire comes in contact with +12V.

1. Identify switched +12 volt wire and tach wire (if equipped) going to the coil. Refer to your service manual, or reconnect the battery and use a test light or voltmeter. The switched +12 volt wire will be hot when the ignition key is turned on.
2. Refer to Figure 5, 6, or 11 depending on your application. Connect the HI-4N white wire and switched +12 volt wire to Coil + (positive).
3. Connect the HI-4N pink wire to the Coil – terminal on the coil for the front cylinder.
4. Connect the HI-4N blue wire to the Coil – terminal on the coil for the rear cylinder.
5. Connect the HI-4N violet wire to the vacuum switch (Figure 3, item 18), if used.
6. Connect the HI-4N brown wire to the tach wire, if equipped with a tachometer. Tape up if unused.
7. The HI-4N is grounded via the timing housing; a separate ground connection is not required.
8. Reconnect battery ground cable. Verify proper ground connections to the frame and engine.

Figure 3. Harley-Davidson® 1980 and Later OE Electronic System

1. Screws (2)
2. Washers (2)
3. Ignition Module
4. Well Nuts (2)
5. Rivets (2)
6. Outer Cover
7. Inner Cover Screws (2)
8. Inner Cover
9. Gasket
10. Sensor Plate Screws & Washers (2 each)
11. Sensor Plate
12. Rotor Screw & Star Washer
13. Rotor
14. Gear Case Cover
15. Ignition Coil
16. Ignition Coil Terminal
17. Spark Plug Wires (2)
18. Vacuum Operated Electrical Switch (VOES)
19. VOES Connector
20. Sensor Connector

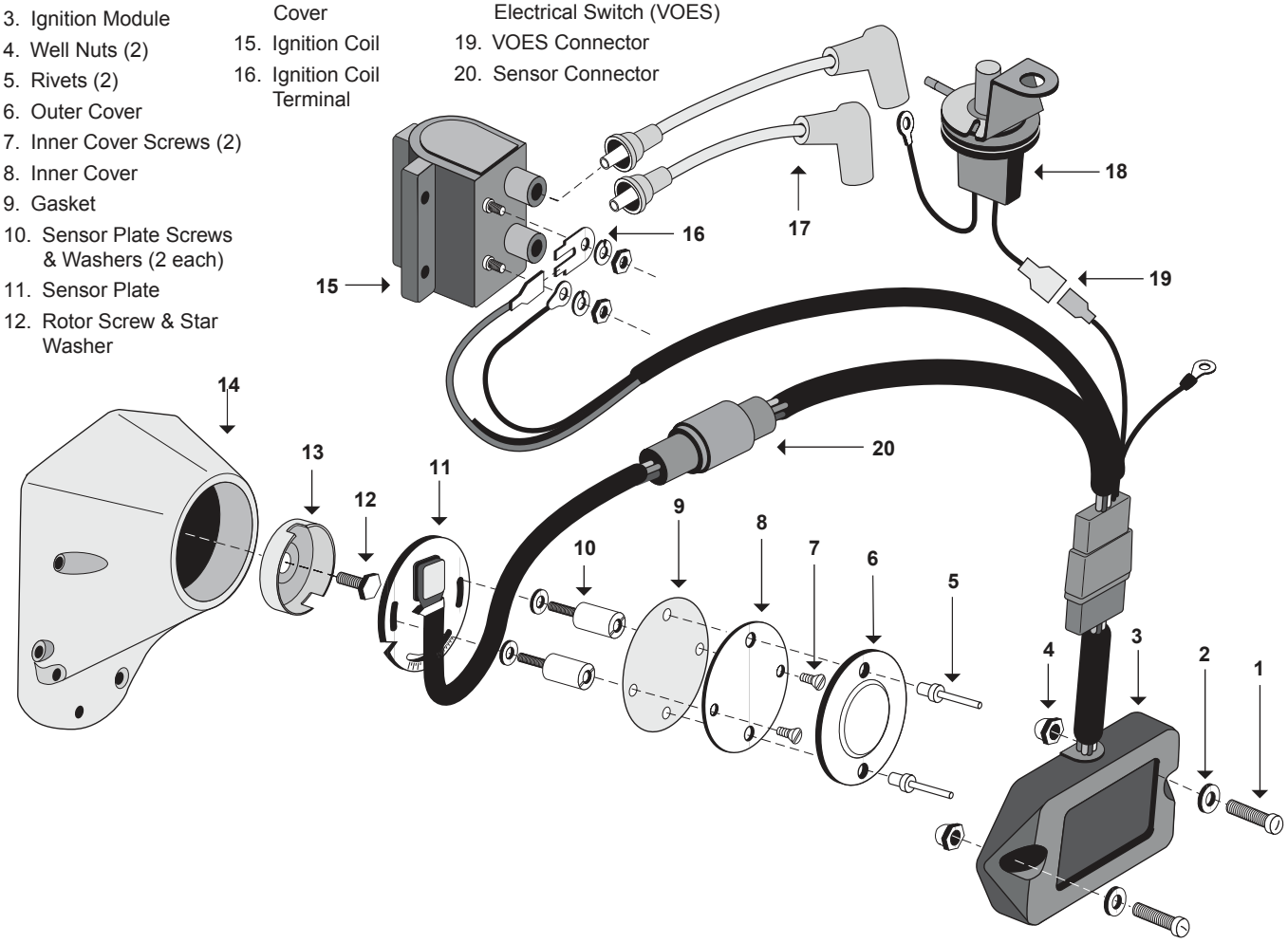
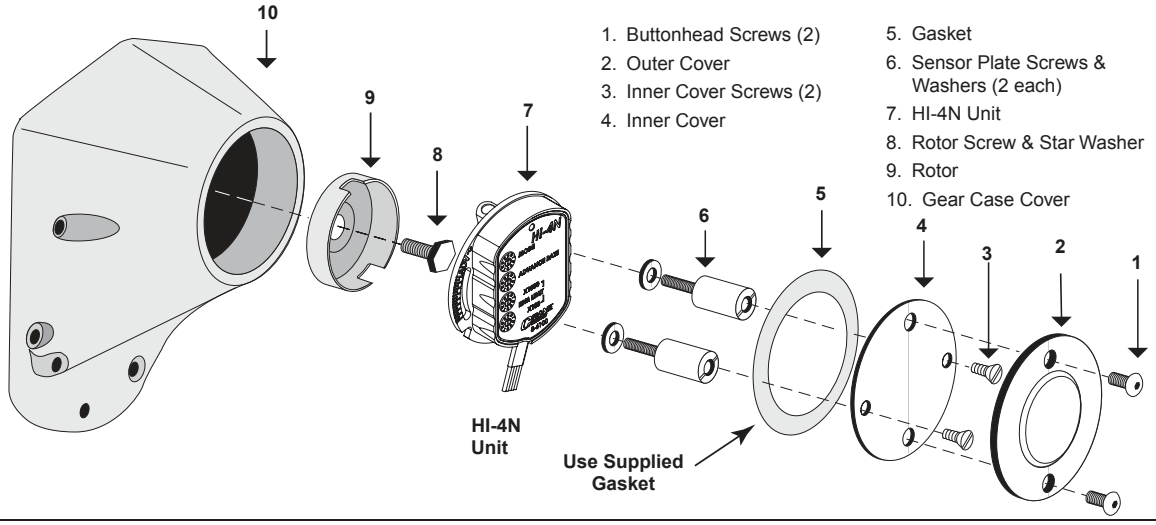


Figure 4. HI-4N Ignition System Installation

1. Buttonhead Screws (2)
2. Outer Cover
3. Inner Cover Screws (2)
4. Inner Cover
5. Gasket
6. Sensor Plate Screws & Washers (2 each)
7. HI-4N Unit
8. Rotor Screw & Star Washer
9. Rotor
10. Gear Case Cover



NOTE: Most motorcycle coils do not have terminals marked. Most singlefire coils use the center terminal for +12V and the outer two terminals for front and rear cylinder Coil–. For dualfire coils use either terminal for Coil+ and the other one for Coil–.

VOES HOOKUP

The OE vacuum switch (VOES) is normally an open circuit. Above 3-5 inch-Hg vacuum, the VOES closes and grounds the vacuum input on the OE module. This increases the total advance generated by the OE ignition module. Vacuum advance improves part throttle driveability and fuel economy. Connect the VOES to the HI-4N violet wire as shown in Figures 5, 6, and 11.

NOTE: 1996 and later models use a 2 wire connector between the VOES and the OE harness. Connect one wire from the VOES switch to frame ground and connect the other wire to the VOES input (violet wire) on the HI-4N.

MODELS WITHOUT OE VACUUM SWITCH (VOES)

This includes most models prior to 1985. Fuel economy and driveability will be improved if you install a VOES and connect it to the HI-4N violet wire as shown in Figures 5, 6, and 11. We recommend you use H-D® VOES P/N 26566-91. If the VOES is not used, tape up the violet wire.

HI-4N SETUP AND OPERATION

Refer to the cover plate on the HI-4N, and the switch table on page 6. The unit has four switches that select the operating modes, advance rate, and rev limit.

The top switch sets the operating mode. Use the OEM with VOES advance curve for stock and modified engines with OE electronic or points ignition. Use the Race Only advance curve for high compression engines. Kick start mode fires the first cylinder for quick starting. Electric start mode delays firing for 2 revolutions of the crankshaft for smoother starts and less strain on the starter.

The advance curve is adjustable over a limited range via the advance rate switch (SPK ADV). Advance curves are given in

Figure 5. HI-4N Single Fire System Hookup with Single Plug Heads

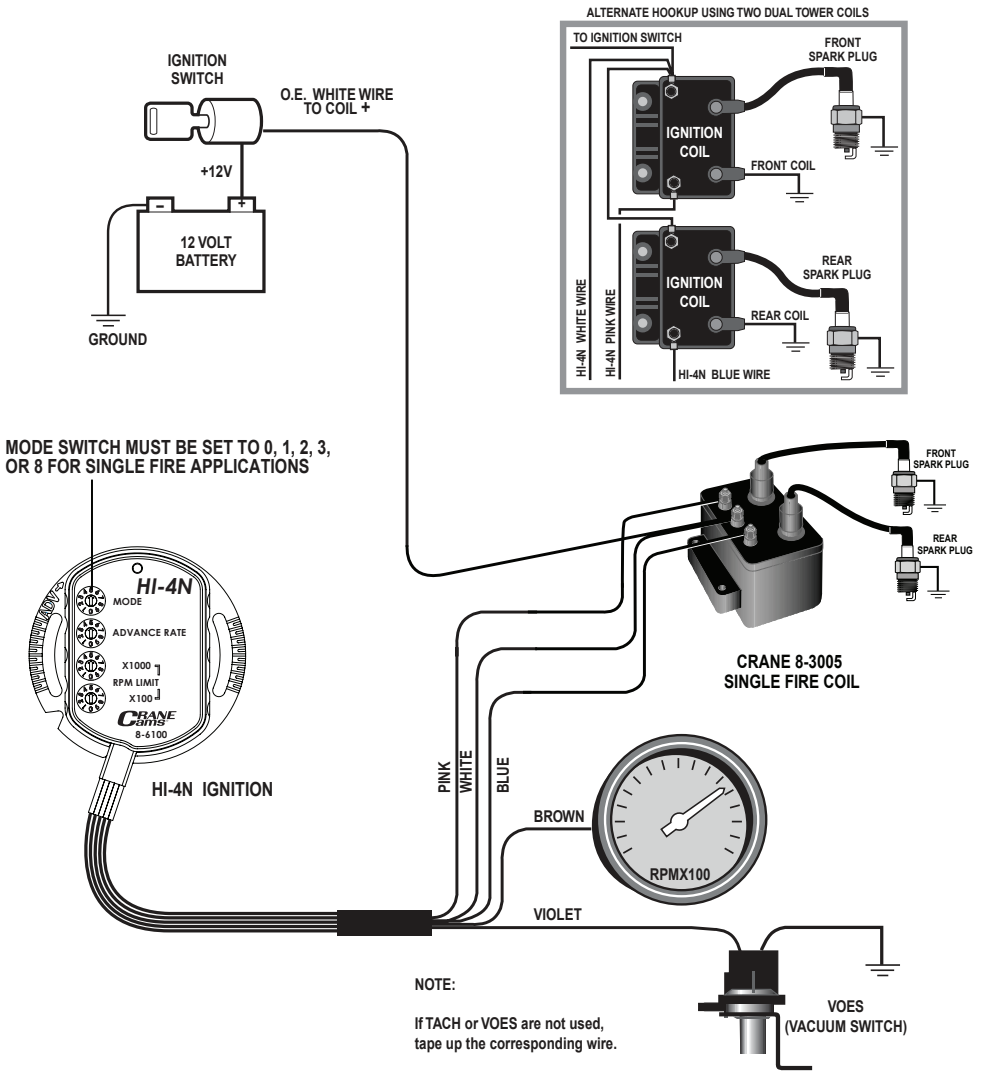
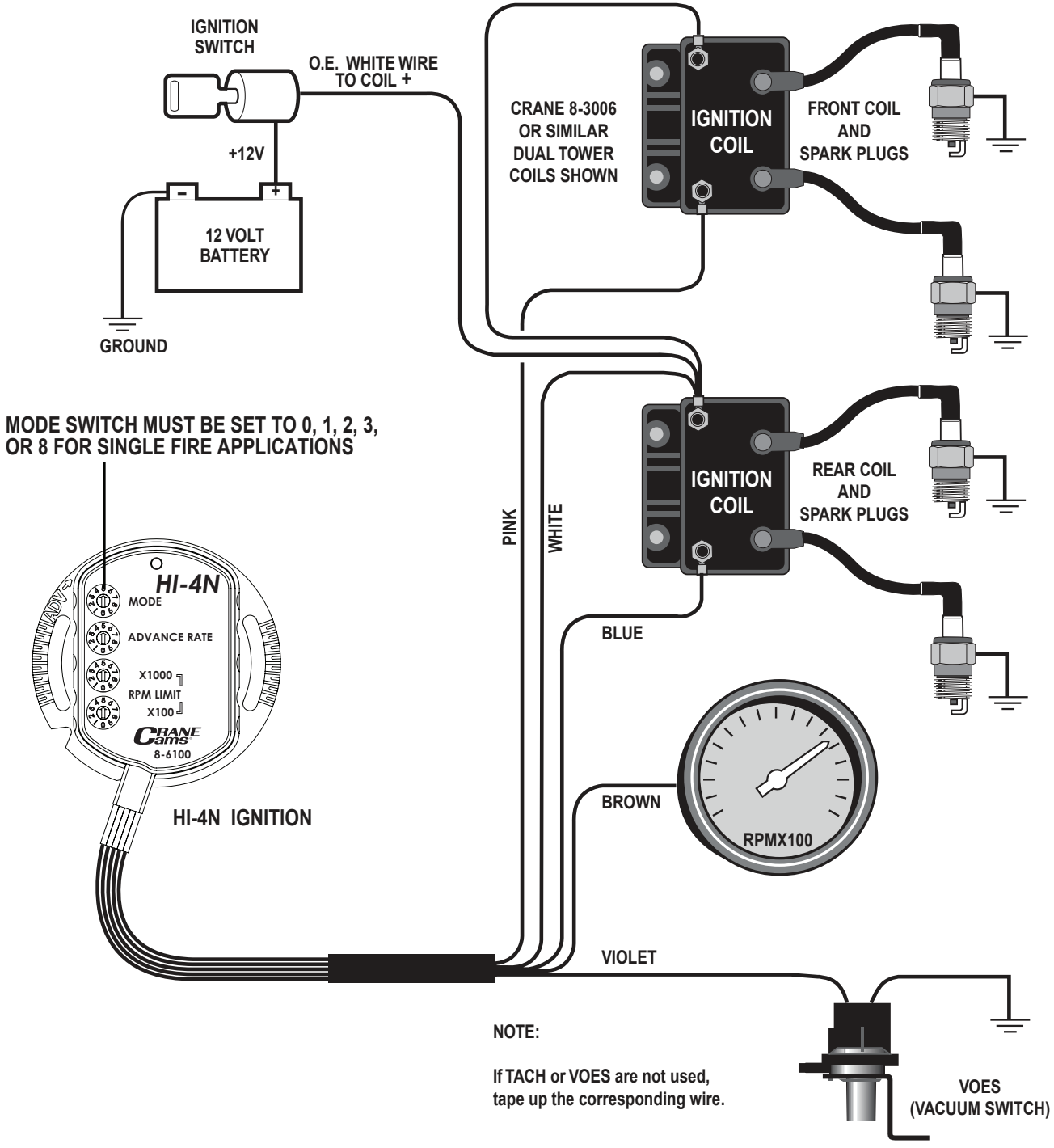


Figure 6. HI-4 Single Fire System Hookup with Dual Plug Heads



Figures 7 and 8. Each set of advance curves includes minimum and maximum curves. The actual advance curve will be between the minimum and the maximum curves depending on the advance switch setting.

If you have a passenger or are using low octane gasoline, minimum advance will reduce spark knock. Maximum advance will give higher performance, but may require the use of high octane gasoline.

The RPM limit switches (RPM LIMIT) are adjustable from 1,500 to 9,900 PRM. Use a safe RPM for your engine. Do not set RPM limit below 1500.

The HI-4 timing LED should light up when the ignition key is turned on. The timing LED will go off when the crankshaft is rotated past TDC. During cranking, the LED will blink.

MODE SWITCH SETTINGS

0	Single Fire, Single Spark, Race Curve, Electric Start
1	Single Fire, Single Spark, OE Curve, Electric Start
2	Single Fire, Multi Spark, Race Curve, Electric Start
3	Single Fire, Multi Spark, OE Curve, Electric Start
4	Dual Fire, Single Spark, Race Curve, Electric Start
5	Dual Fire, Single Spark, OE Curve, Electric Start
6	Dual Fire, Multi Spark, Race Curve, Electric Start
7	Dual Fire, Multi Spark, OE Curve, Electric Start
8	Single Fire, Single Spark, OE Curve, Kick Start
9	Dual Fire, Single Spark, OE Curve, Kick Start

TIMING MARKS

The TDC and advance timing marks are located on the flywheel and can be observed via an inspection hole (refer to shop manual for details). Refer to Figure 9 for typical timing marks. Early Style includes most 1980 and earlier models. Late Style includes most 1981-95 models. If the shop manual is not available, remove spark plugs, turn engine until front piston is at TDC on compression stroke and identify TDC mark on the flywheel. Refer to Figure 9 and find the diagram with a matching TDC mark. Use the corresponding advance mark shown in the diagram.

NOTE: 1996 and later models (1995 and later for export models) have a timing mark at 20° BTDC for setting the timing with the OE ignition module. Do not use this mark for setting the timing on the HI-4N. In most cases an additional mark will remain at 35° BTDC (see Figure 9). Use this mark to set the timing with a timing light as described below.

INITIAL STATIC TIMING PROCEDURE

In most cases, aligning the V notch on the HI-4N plate to the same location as the OE plate will set the timing close enough to start the engine. If the engine will not start or runs very rough, you can use the following static timing procedure.

Figure 7. OEM (with VOES) Advance Curves Based on TDC Initial Timing

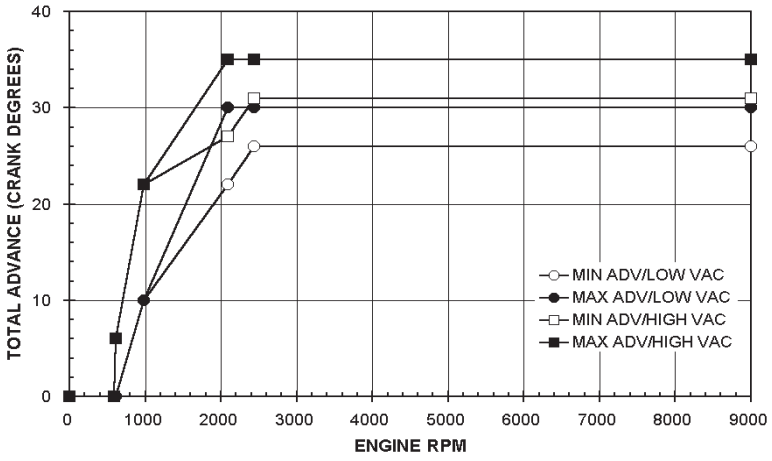


Figure 8. Race Advance Curves Based on TDC Initial Timing

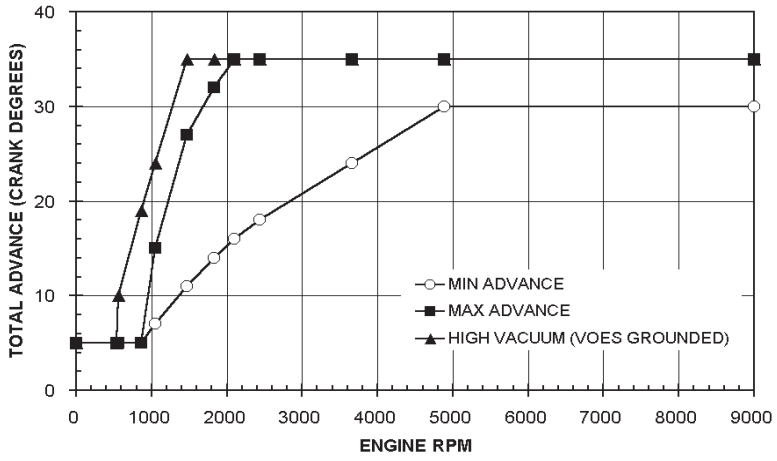
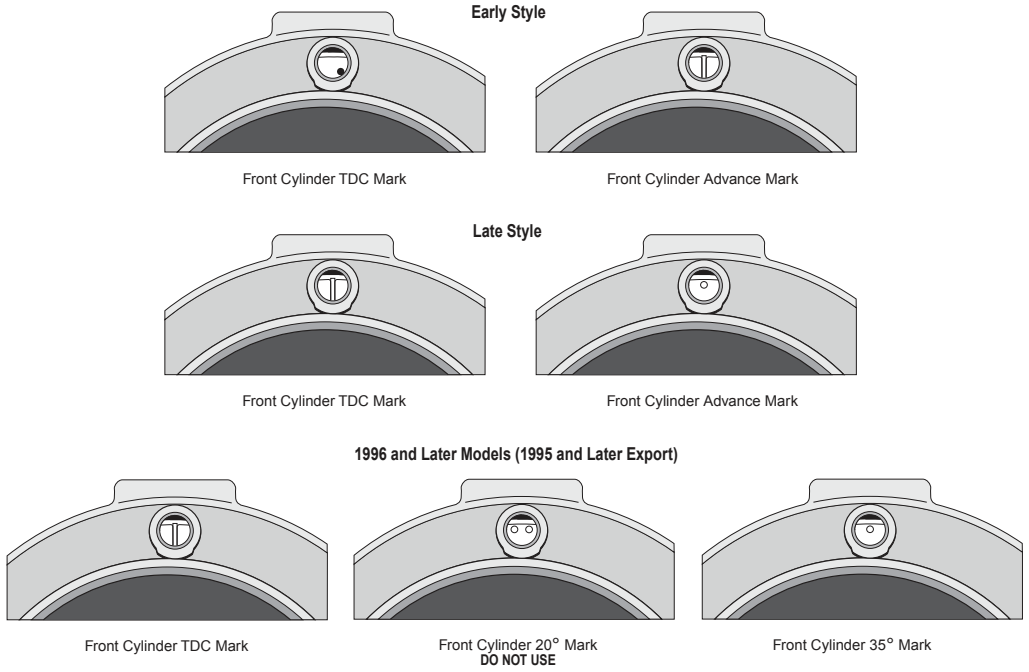


Figure 9. Top Dead Center (TDC) and Front Cylinder Advance Marks for Various Models



Remove spark plugs and turn engine until TDC mark appears in observation hole. Ground spark plugs with an alligator clip so you will not shock yourself. Turn on ignition. Loosen the standoffs holding HI-4N and rotate unit clockwise until timing LED goes out. The point at which LED goes off is TDC. Timing is now set approximately at TDC. Turn off ignition and reinstall spark plugs. Once the engine has been started, you must set the timing with a timing light.

The tic marks on the outside of the ignition mounting slots can be used for timing reference. There is 10° between the large tic marks and 5° between the large and small tic marks.

Increase the advance by rotating the ignition clockwise as shown by the ADV marking and arrow on the ignition near the Mode Select switch. (Figure 10)

Most kick start application work best with an initial timing of 8°. Electric start applications work well with 5°.

SETTING ADVANCE TIMING USING STANDARD TIMING LIGHT

This timing procedure requires that a VOES switch be connected to the HI-4N. For racing and early points applications without a VOES switch, you must ground the VOES input (HI-4N violet wire) while setting the timing. Connect a timing light to the front cylinder. Set the HI-4N advance switch to midrange. Run the engine at 2,400 to 2,500 RPM. Adjust HI-4N position until advance timing mark is centered in the observation hole. Tighten the standoffs and verify that timing has not shifted.

SETTING PRECISE ADVANCE TIMING FOR RACING USING DIAL BACK TIMING LIGHT

Determine the advance you want at 2,500 RPM. Use a dialback timing light. Set the amount of advance you want, say 35 degrees, on the dial-back timing light. Connect the dial-back timing light to the front cylinder. If the VOES is used, disconnect the VOES input (HI-4N violet wire) while setting the timing with this procedure. Set the HI-4N advance switch to position 9 for maximum advance. Run the engine at 2,500 RPM. Adjust HI-4N position until TDC timing mark is centered in the observation hole. You will now have the amount of advance you dialed into the timing light. Tighten the standoffs and verify that timing has not shifted. Most dial-back timing lights will be compatible with single fire systems.

ADVANCE CURVE SETUP

After you have set the timing as explained above, set the HI-4N advance switch to desired position. If you run 93 octane gasoline, you can set the switch to position 9 for maximum advance and performance without spark knock. High compression engines may require less advance. You should use the Race Only advance curve for high compression engines.

Figure 10.

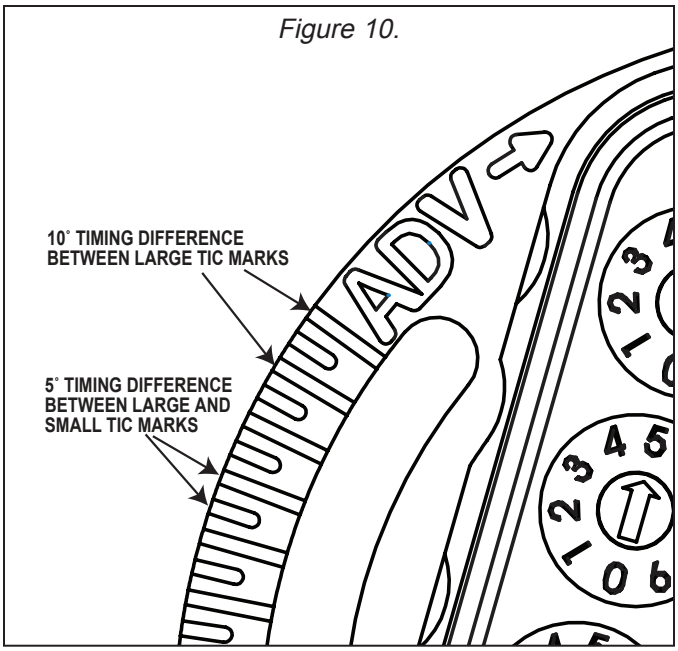
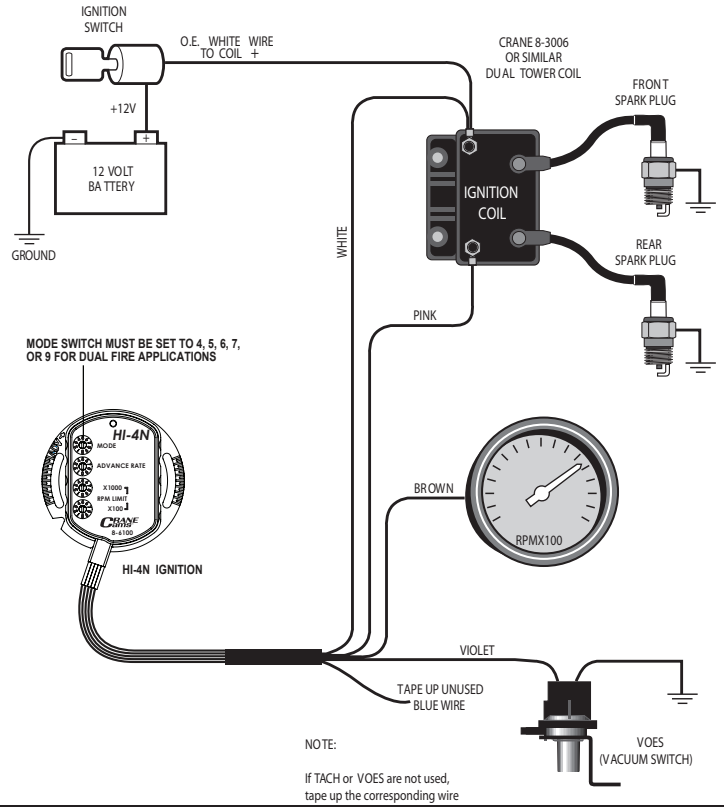


Figure 11. HI-4N Dual Fire System Hookup



COVER PLATE ASSEMBLY

You can re-use the OE hardware, and the supplied Crane Cams gasket for the HI-4N. For models with a riveted outer cover, use the supplied self-threading screws in place of the rivets.

TROUBLESHOOTING

Did the engine run properly before installation of the HI-4N? If not, remove the HI-4N, reinstall the OE ignition or another known good unit and then find and correct the original problem. Did the HI-4N function correctly before the problem occurred? If the answer is yes, did you change anything that may have affected it? Try going back to the last setup that worked OK to help isolate the problem.

If the engine will not start, or runs rough or intermittently, use the following checklist steps:

ENGINE WILL NOT START

NOTE: The battery ground on most Harley- Davidsons® is connected to the frame behind the seat. In order to provide a dedicated ground for the high starter current, another cable should be installed from the point on the frame that the battery is already grounded to the starter mounting flange. This cable should be the same diameter as the battery ground cable presently on the bike, and will help prevent damage to your electronic components.

1. Check that timing LED lights up and **stays on** when ignition key is first turned on. If not, check for +12 volts on white wire from HI-4N.
2. Check that timing LED blinks while engine is cranked.
3. If the timing LED blinks, but engine will not start, recheck all wire harness connections or replace coil(s).
4. Check for low voltage from a faulty or marginal charging system and battery.
5. If all of the above conditions have been checked, contact tech-support for assistance.

CHECKING FOR SPARK

To crank the engine and check for spark, use a KD Tools test plug or H-D® tool HD-26792. These test plugs come with an alligator clip that must be attached to frame or engine ground. Use a length of spark plug wire to connect the test plug to the coil.

WARNING: Never crank the engine with any spark plug wire disconnected.

MISFIRE OR INTERMITTENT OPERATION

Field experience has shown that popping back through the carburetor, misfiring, and intermittent failure (especially after the engine gets hot) are usually not caused by electrical problems within the HI-4N. Carburetor problems, fouled spark plugs, coil failure, and loose wire harness connections are the most common culprits. Also, verify that spiral core or suppression type spark plug wires and resistor spark plugs are being used.

TACH INOPERATIVE

If the tach is inoperative after installation of the HI-4N, you may require a tach adapter. The HI-4N tach output is compatible with ground sensing tachs which includes most OE and aftermarket tachs. Some tachs require a high voltage trigger pulse. In this case, install Crane Cams tach adapter P/N 8-2050. Note that the tach will read correctly at the rev limit only if it is connected to the brown wire from the HI-4N. Damage to the HI-4N circuitry may have occurred if 12 volts was applied to the brown tach wire at any time.